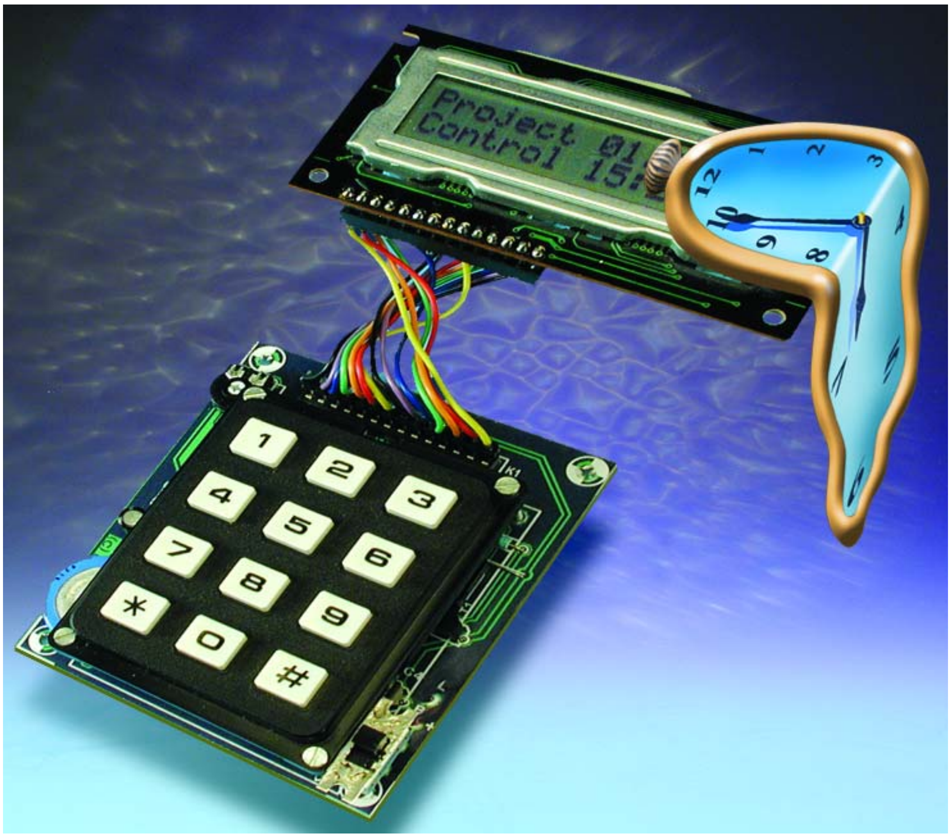
Project Timekeeper

Keep track of several projects at once using a PIC16F84

Design by W. Wätzig

This special timekeeper records individual time periods and adds them together to produce a total time. The circuit uses a real-time clock device, backed up by a 'Goldcap' capacitor.



When working on a project the time spent in each individual work session often needs to be recorded. Written notes may be made as follows:

Period 1: October 7 from 8:13 to 8:55
Period 2: October 7 from 8:56 to 9:32

and so on. The differences between the recorded times must be worked out, and then added together to arrive at the total time spent. The device described here was developed to simplify this task. It can keep track of the total time spent on up to nine separate projects. Indeed, it can be used to measure time durations in any application as long as no great precision is required: for example, the duration of a competition, or the operating time of (household) equipment, or the length of an experiment.

The circuit (**Figure 1**) is based around the familiar PIC16F84 8-bit microcontroller from Microchip and the Dallas Semiconductor DS1302 real-time clock (RTC). Information is displayed on a liquid crystal display with 2 rows of 16 characters. Control is via a telephone-type keypad with the digits '0' to '9' as well as star ('*') and hash ('#'). The keypad is arranged as a matrix with three columns and four rows and is connected to port B. Buzzer B1 is also connected to this port via T1, and gives audible confirmation of each keypress. RA4 enables the keypad and buzzer. Port line RA2 enables and disables the display, while the display contrast can be adjusted using P1.

Operation

Time measurement for project *N* is started by pressing '****N**'. *N* can be from 1 to 9. This causes the time to be read from the real-time clock and copied into EEPROM in the microprocessor. The display shows the value of *N* along with the date and time. The device can now be turned off: the RTC will continue to be powered from the reservoir capacitor.

Timing for the current project is stopped by pressing '##'. The time is again read from the RTC and the stored start time is subtracted from

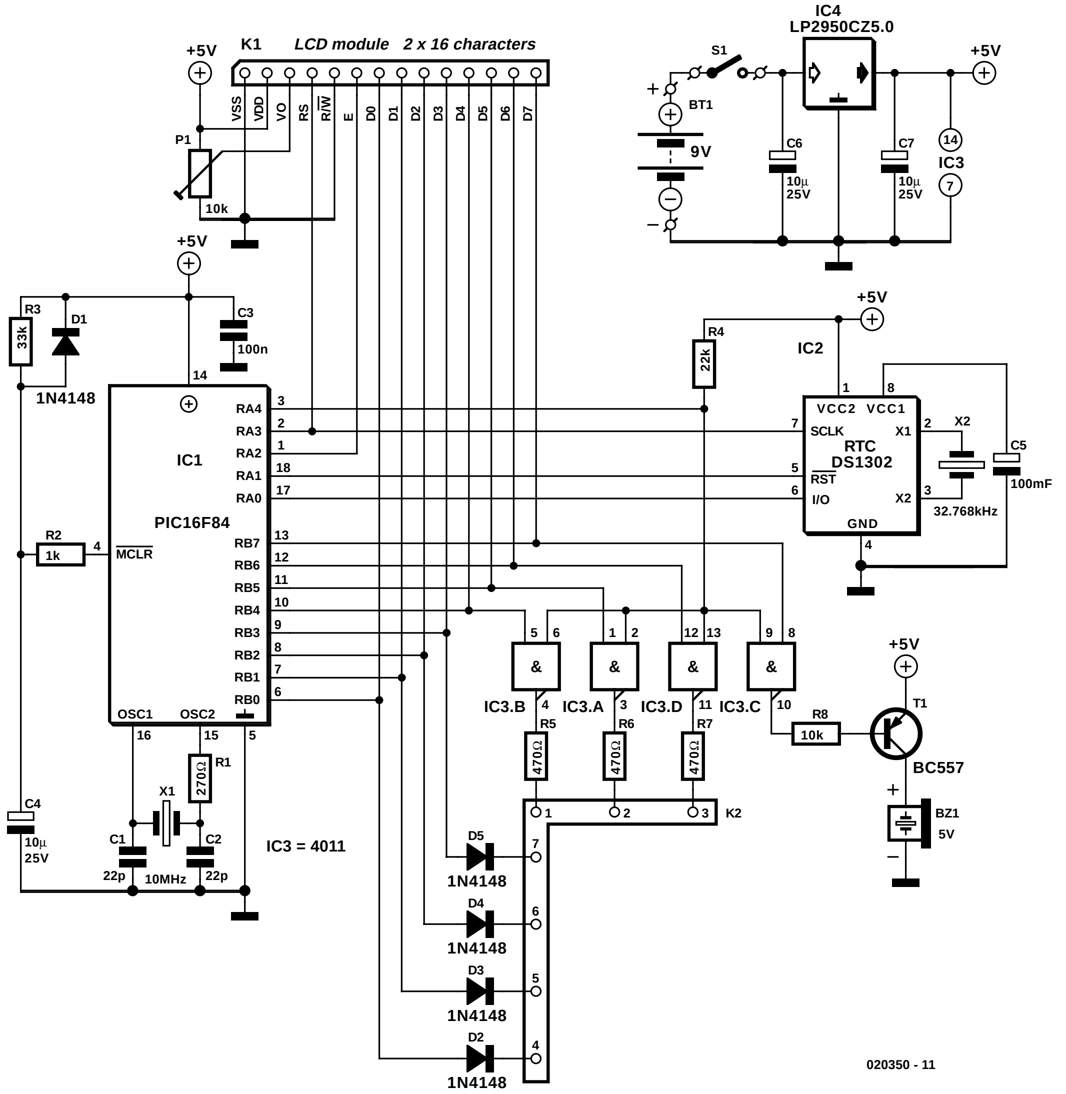


Figure 1. The circuit is based around the familiar Microchip PIC16F84 8-bit microcontroller and the Dallas Semiconductor DS1302 real-time clock (RTC).

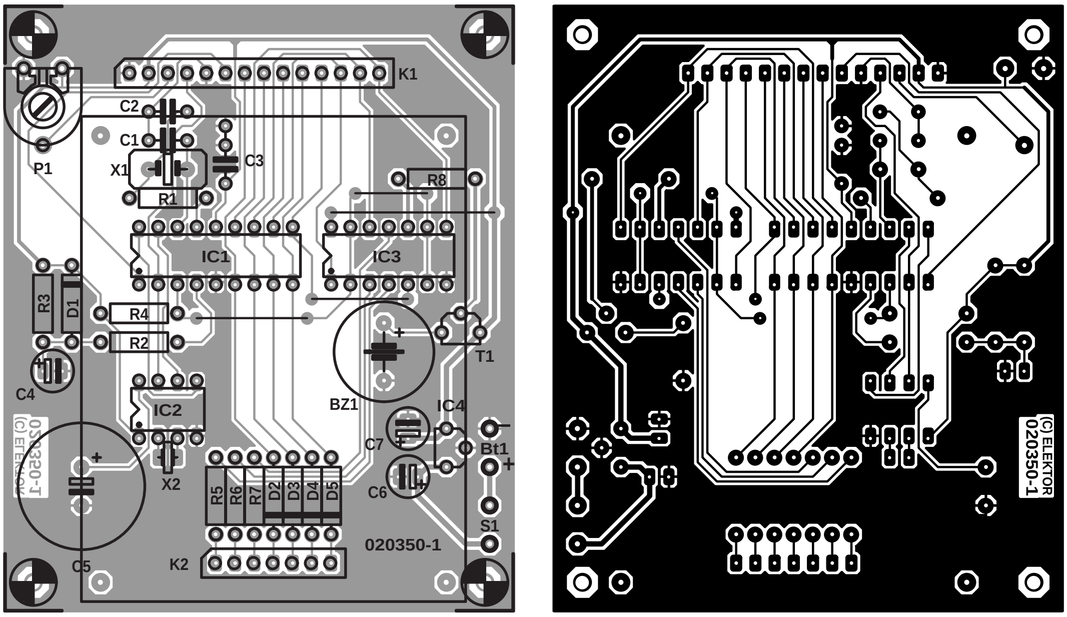


Figure 2. Printed circuit board layout and component mounting plan for the project timekeeper.

COMPONENTS LIST

Resistors:
R1 = 270Ω
R2 = 1kΩ
R3 = 33kΩ
R4 = 22kΩ
R5,R6,R7 = 470Ω
R8 = 10kΩ
P1 = 10kΩ preset H

Capacitors:
C1,C2 = 22pF
C3 = 100nF
C4,C6,C7 = 10µF 25V radial
C5 = 100mF 5.5 V Goldcap

Semiconductors:
D1-D5 = 1N4148
T1 = BC557
IC1 = PIC16F84-10P, programmed, order code **020350-41** (see Readers Services)
IC2 = DS1302
IC3 = 4011
IC4 = LP2950CZ5.0 (low-drop voltage regulator, 5V, TO92 case)

Miscellaneous:
K1 = 14-way pinheader
K2 = 7-way socket strip
BZ1 = buzzer, 5 V_{DC}
BT1 = 9V battery (6F22) with clip-on leads
X1 = 10MHz quartz crystal
X2 = 32.768kHz quartz crystal
S1 = on/off switch
2 x 16 character alphanumerical LCD Module
Telephone keypad (4x3 matrix), e.g., Conrad Electronics # 709840

PCB, available from The PCBShop

Disk (source & object code), order code **020350-11** or Free Download

Table 1

Control commands

**N	start project number N			
##	stop current project			
#0*N	clear time information recorded for project N			
N	show time information recorded for project N			
#*n	set RTC register n	n=0	seconds	xx = 00-59
		n=1	minutes	xx = 00-59
		n=2	hours	xx = 00-23
		n=3	date	xx = 01-31
		n=4	month	xx = 01-12
		n=5	day of week	xx = 01-07
		n=6	year	xx = 00-99
*#n	read RTC register n			

it. The result is added on to the accumulated time for the relevant project stored in EEPROM. The result of the calculation is displayed in the format **days/hours:minutes**.

By pressing one of the number keys from 1 to 9 the accumulated time for the corresponding project is called up on the display for three seconds. It is shown in the format **dd hh mm**.

Table 1 shows a list of the commands recognised by the project timekeeper. When first switched on, the time and date must be set. It is recommended to set the year first, followed by the month, day, hours, minutes and seconds, in that order. Note also that the seconds register should be set to **zero** in order to start the RTC. After a reset (i.e., when power is first applied), the RTC sets the seconds register to **80** and enters a 'wait' mode.

The current consumption of the device is around 4 mA, and so a 9 V PP3-type battery should give a long life. Voltage regulator IC4 should be a low drop-out type in order to squeeze the last milliamp-hour out of the battery.

Construction

A generously-proportioned printed circuit board (**Figure 2**) has been designed for the project timekeeper. There should be no particular difficulties encountered during construction, as long as care is taken to fit the polarised components the right way around. The three ICs can be fitted in sockets. The keypad matrix should fit neatly into seven-way connector K2, and the LCD in K1. This results in a compact unit which can be built into a small plastic enclosure.

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